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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

RAO, SHRINIVAS H

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 03/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/879,208	OOWAKI ET AL.	
	Examiner	Art Unit	
	Steven H. Rao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 14-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Response to Amendment

Applicants' amendment filed on January 03, 2005 has been forwarded to the Examiner on January 19, 2005.

Therefore claims 14, 18, 22 and 27, as amended by the amendment and claims 15, 17, 19-21, 23-26 and 28-33 as previously recited are currently pending in the Application.

Claims 34-39 were cancelled.

Claim Objections

Claims 14-33 are objected to because of the following informalities:

Independent claims 14, 18, 22, 27 and 32 are objected to because consistent terminology is not used to identify same elements in the claims.

Claim 14 lines 2 and 4 recites source/drain regions whereas lines 10, 12 and 14 recite "impurity diffusion region" to mean the same previously recited source/drain regions. (see figure 3 E and 4C_D # 2 applicants' response pages 10-11).

Claims 18, 22, 27 and 32 have similar corresponding recitations.

Dependent claims 15-17, 19-21, 23-26 and 28-33 are objected to at least for depending upon objected independent claims.

Similarly, claim 18 line 5 instead of reciting "selectively forming a first film on said semiconductor substrate" which can be recited as "forming a first film on a portion of said semiconductor substrate".

Further the first film should be identified as "first oxide film".

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Claim 22 after 5 is missing steps Like etching step , second film formations step , after line 8 no removal of second film step ,etc.

It is suggested that Applicants' use claim 18 as template for a single embodiment of their invention and recite separate independent claim for each embodiment they intend to claim .

Appropriate correction is required.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

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the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Further claim 18 seems to recite steps up to line 16 that are described in figs. 3 A to 3C and then recite steps that are shown 6 D and 6 E , yet the description of 2A to 3 and col. 2 lines 21-53 forming an impurity diffusion region including a pad of a bottom of the first groove to form self-aligned source/drain regions in small channel drawings identifies these two figures as separate embodiments one and four.

In view of the numerous claims and lengthy specification, drawings etc. Applicants' must ensure that all claimed steps of all the claims are clearly shown in figures that to a particular embodiment and not several embodiments from several figures.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 14 -31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin (U.S. Patent No. 5,270,257, herein after Shin) previously applied and further in view of Wen (U.S. Patent No. 5,949,1 16, hereinafter Wen) (for res[ponse to Applicants' contentions see section below).

With respect to claim 14, Shin describes a method for producing a MIS transistor comprising a semiconductor substrate, (Shin fig. 3a # 21 , col.4 line 19) source/drain regions formed on the semiconductor substrate, (Shin figure 3 c # 26b,a, col. 4 lines 46-47) and a gate electrode provided above a channel region between the source/drain regions, (Shin fig. 3b # 24, col. 4 line 41 and region below gate 24 and oxide 23) said method comprising: selectively forming a first film on said semiconductor substrate, (Shin fig. 3 c-e # 22-nitride) etching said semiconductor substrate to form a first groove by using said first film as a mask; (Shin Figure 3A) forming a second film in said first groove (Shin fig. 3 b# 23/25) and thereafter removing said first film; (Shin fig. 3C) .

Shin does not specifically disclose the steps of forming an impurity diffusion region including a pad of a bottom of the first groove (i.e. an impurity diffusion region) diffusing an impurity on a surface of said semiconductor substrate to form an impurity diffusion region including a part thereof extending below the first groove by using said second film as a mask; forming an insulator film on said impurity diffusion region and thereafter removing said second film to form a second groove in the semiconductor substrate.

However, Wen , a patent from the same filed of endeavor , describes in figures length devices (figs. 2A to B length devices (figs. 2A to B an d col. 2 lines 21-52, col.2 lines 44-46) to provide a process for fabricating a Mos device that allows a contact widow elsewhere than source/drain region thus resulting in smaller device .

Therefore it would have been obvious to one of ordinary skill in the art , at the time of the invention to include Wen's step of forming an impurity diffusion region

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including a part of a bottom of the first groove to form self-aligned source/drain regions in small channel length devices in Shin's method , the motivation to make the above combination is to provide a process for fabricating a Mos device that allows a contact widow elsewhere than source/drain region thus resulting in smaller device . (Wen col. 1 lines 49 to57).

The remaining limitation of claim 14 are :

and thereafter removing the second film to form a second groove on the semiconductor substrate (Figure 2C removal of 201,207) so that a top surface of the impurity diffusion region of the semiconductor substrate is higher than a bottom surface of the second groove, (figure 2C 200 above 209) forming a gate insulator film in said second groove and controlling a thickness of the gate insulator film so that a top surface of said gate insulator film is higher than a top surface of said impurity diffusion region' (interpreted to mean 'i and" instead of with" -see 1 12 objection above) and forming a gate electrode on the top surface of said gate insulator film. (Wen figure 2 D to F, gate insulator film 210 , 2 11) .

With respect to claim 15, wherein the second film is semiconductor film (Shin film 24 is poly silicon , Shin col. 4 line 41) and forming a sacrificial film in the first groove before forming the second film in the first groove (Wen figs. 2 B and C) removing the sacrificial film after removing the second film to form the second groove. (Wen fig. 2B # 207and Figure 2C).

With respect to claim 16, wherein a step of polishing a surface of the second film by using the first film as a stopper (Shin fig. 1 1 , col. 6 lines 66-67).

With respect to claim 17, forming a protective film in the second groove before forming the gate insulator film in the second groove (Shin fig. 14 # 285).

With respect to claim 18, it repeats all the steps of claim 14 (see above) and further includes the step of : polishing the gate insulator film by using the insulator film as a stopper (Shin fig. 1 1, col. 6 lines 66-67).

Claims 19-21 repeat the steps of claims 15-17 and are rejected for reasons set forth above.

Claim 22 repeats the steps of claim 18 except for the absence of the second film-forming step and is rejected for reasons stated under claim 18 above.

Claims 23 wherein the source/ drain regions are elevated by an epitaxial growth technique before the diffusion step. (Shin fig. 3 e # 28a and b, col. 4 lines 65-68).

With respect to claim 24, wherein the a diffusing step is carried out before elevating the source/drain region by epitaxial growth. (See above claim 23 and further it is well settled that changing the order of performing the methods steps is prima facie obvious unless the change in the sequence of steps can be shown to produce unexpected results or is critical to the method).

It is also noted that the specification contains no disclosure of either the critical nature of the claim sequence of steps or any unexpected results arising there from. Where patentability is said to be based upon particular chosen dimensions or upon variable recited in a claim, the Applicant must show the chosen sequence are

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critical. In re Woodruff 919 F.ZD. 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990).

Claims 25-26 repeat the steps of claims 19 and 21 above and are rejected for reasons stated above.

With respect to claim 27, repeats the steps of claims 18 and 22 and is rejected for reasons set out above.

Claims 28-31 repeat the steps of claims 23, 24, 25 and 26 and are rejected for reasons set out above.

B. Claims 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shin (U.S. Patent No. 5,270,257, herein after Shin) previously applied in view of Wen (U.S. Patent No. 5,949,1 16, hereinafter Wen) as applied to claims 14-31 above and further in view of Lee (U.S. Patent No. 6,248,622, hereinafter Lee).

With respect to claim 32 , in addition to the steps of claims 18 and 22, claim 32 further recites the source/drain regions forming an inclined surface between the top surface of the semiconductor layers and the channel region (Shin fig. 3e # 26a and b) , forming a dummy film on the channel region that borders the semiconductor layers (part of 24 etched away).

Depositing a gate electrode on a top side of the gate insulator film to form a gate electrode having a cross section of a T shape.

Wen describes the forming of a gate electrode on a top side of the gate insulator film to form a gate electrode . (Wen figs. 2f and 3).

Shin and Wen do not specifically describe the gate having a cross section of a

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T-shape .

However, Lee, a patent from the same filed of endeavor, describes in fig. 3 B-D and col. 5 lines 7-8 describes a metal layer and a damascene structure that has a T-shaped cross-section to form a circuit/device with improved speed and avoiding logical cross-talk errors.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Lee's interconnect having a T-shaped cross section in Krivokapic method to form a circuit/device with improved speed and avoiding logical cross-talk errors. (Lee col. 1 lines 41-44).

Claim 33 repeat the steps of claims 14 and 22,23, 28 and are rejected for the reasons set out above.

Response to Arguments

Applicant's arguments filed on 1/19/ 2005 with respect to claims 14-33 have been considered but not persuasive for the following reasons :

Applicants' first contention with respect to claims 14 and 18 , that Shin's description, namely in figures 3b and 3C and elements 25/25 cannot be considered equivalent to Applicants' recitation " removing a second film to form a second groove" because Shin's element 23 is oxide and element 25 is oxide layer , is not persuasive because Applicants' arguments are not comensurate with presently recited claims.

Applicants second film is a thin sacrificial oxide film 11, (specification page 12 lines 14-15, etc.) , similar to Shin's 23 oxide film or film 25.(also oxide film).

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If applicants' their second film to be polysilicon film 10, then for the above Applicants' argument to carry weight they should recite" second polysilicon film " (which incidentely is similar to Shin's film 24) .

Further film 23 is removed to form second groove (Shin figure 3b col. 4 lines 35-40 23/24 etched) .

Applicants' contention that Shin fails to teach " removing a second film to form a second groove" is based on Applicants' failure to understand the outstanding rejection (which on page 6 line 12 –14 states that Wen in figure 2c describes the removal of elements 201 and 207) and therefore it not necessary for the primary reference(Shin) to also describe what is taught by the secondary reference. If All limitations were taught by Shin as suggested by the Applicants' the outstanding rejection would be a 102 and not 103 rejection.

Applicants' argument on page 13 1 st. full paragraph is again based on incomplete understanding of the rejection . It is not understood where on page 6 of the previous action (mailed on 07/01/2004) the Examiner is said to have 'alleged that Wen teaches or suggests the element " forming a gate insulator film in said second groove at element 203" 'and therefore can only restate the previous rejection wherein forming gate insulator film in said second groove is compared to Wen's element 210 (and not 203).

Therefore a prima facie case of obviousness has been established beyond a shadow of doubt.

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Claims 15-17 and 19-21 were alleged to be allowable because of their dependency upon claim 14.

However as shown above claim 14 is not allowable and therefore claims 15-17 and 19-21 are also not allowable.

Applicants' essentially repeat the same argument (piece meal analysis of individual references) with reference to remaining claims which are also found to be not persuasive.

The motivation to combine the references was previously stated.

Therefore al remaining claims 14-33 are Finally rejected.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

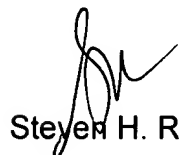
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is (703) 3065945. The examiner can normally be reached on 8.00 to 5.00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Fahmy Wael can be reached on (703)308-4918. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

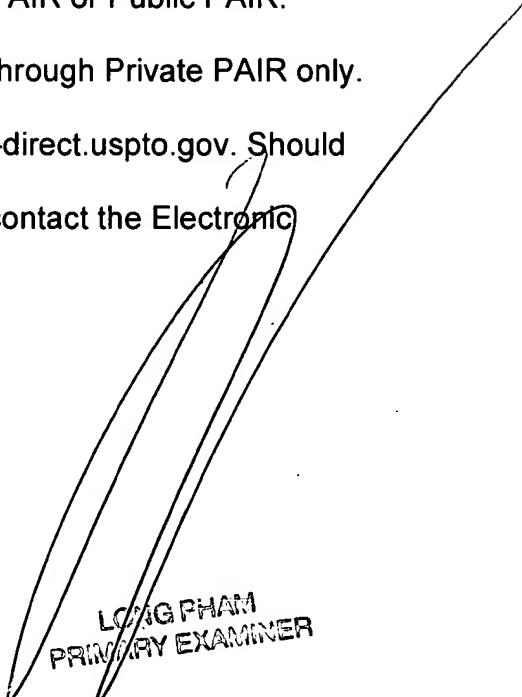
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Steven H. Rao

Patent Examiner

March 19, 2005.



LONG PHAM
PRIMARY EXAMINER